Space Weather Technical Forecast

Issued on Sunday, 07 August 2022 at 00:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/Minor Storm intervals likely, mainly day 2 (8th)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours with only B-class flares. There are currently five numbered regions on the disc, including three small bipolar regions rotating towards the southwest limb, and two further small unipolar regions. There are two further unnumbered region in the northwest disc, including a recently emerged beta spot, and a further unipolar region rotating onto the disc. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, is indicative of slow wind, perhaps ahead of a soon to arrive fast wind. Background speeds were observed, decreasing from 370 km/s to 320 km/s while the density exhibited an erratically rising trend reaching 11-15 ppcc. The total interplanetary magnetic field (IMF), Bt, also showed a rising trend, from weak levels at 5nT to peak moderately at 9nT. The north-south component, Bz, was mainly positive (northward) ranging -1nT to +9nT. The Phi angle was mostly negative (towards the Sun), but has shown brief positive rotations since 07/2230 UTC. Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at background levels. The high energy electron flux (greater than 2 MeV) was at background levels. Electron fluence was below the Active (1e8 integrated pfu) threshold with observed fluence of 1.7e6 integrated pfu at 07/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low or very low solar activity is forecast with only a slight chance of an M-class flare.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Solar winds are likely to become enhanced through day 1 and day 2 (7th and 8th), as consecutive fast wind arrivals occur from CH09 and CH10, the latter of which is likely to be strong and faster with Elevated solar winds of around 550-600 km/s expected, and only gradually easing by day 4 (10th). Geomagnetic activity will initially be Quiet to Unsettled with Active spells possible, with a chance of isolated G1/Minor Storm intervals day 1 (7th). Activity rising further to Active to G1/Minor Storm intervals day 2 (8th). Easing to Quiet to Active by day 4 (10th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to increase day 3 onward, due to fast wind arrivals, perhaps peaking at high during periods of diurnal maximum. The associated 24 hr fluence is expected to remain below the Active threshold (1e8 integrated pfu), but with a rising trend, and a chance of rising above Active by day 4 (10th)

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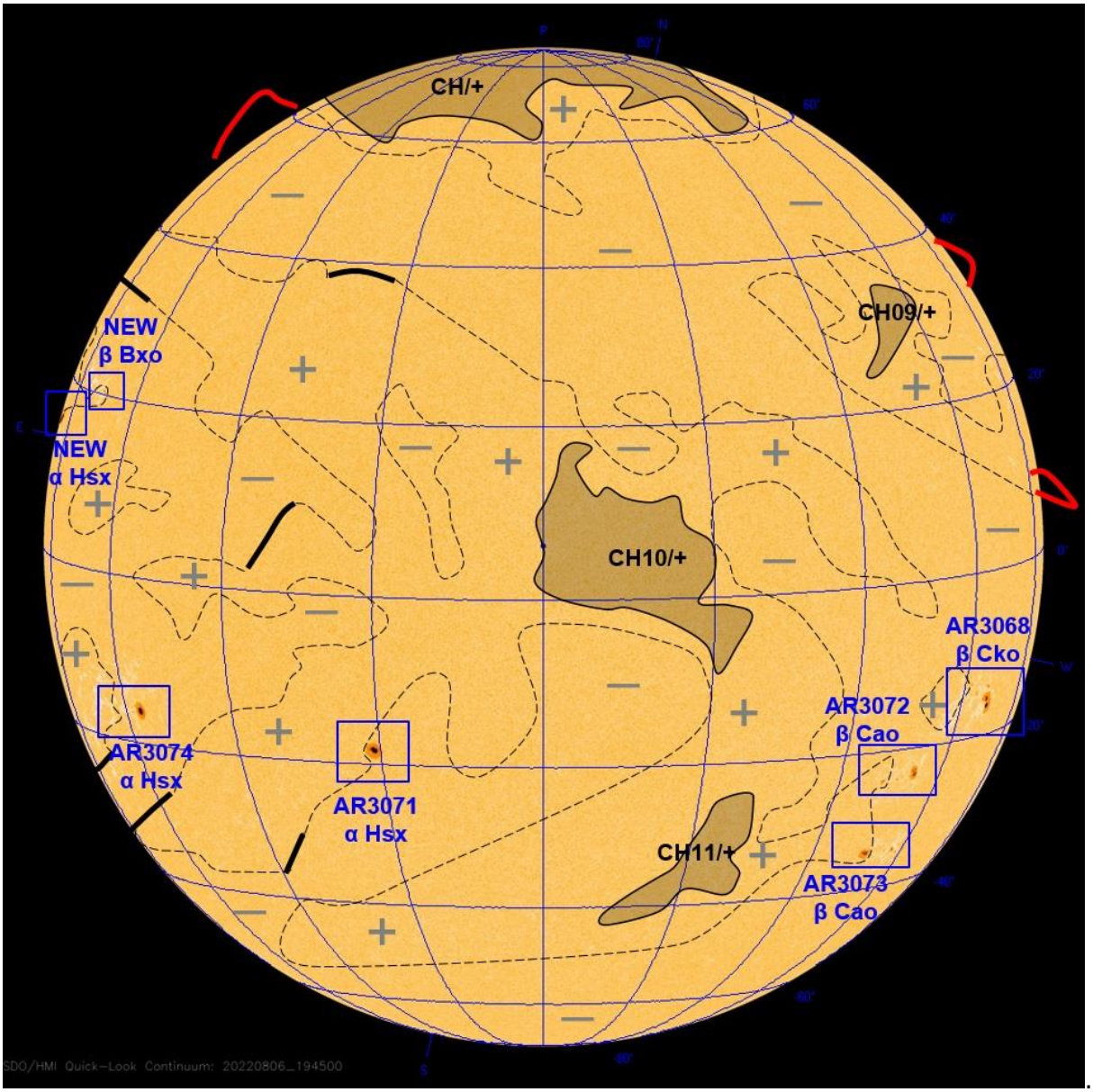
Figure 1. Solar Analysis Valid 06/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs.

Earth is expected to soon move into the fast wind of CH09/+, which is a small coronal hole on the northwest disc, and likely the source of an enhancement seen at STEREO A in the last two days. Solar winds likely to become slightly elevated for a brief period.

The most notable feature is large central disc coronal hole CH10/+. This is a persistent feature, but much larger, darker and distinct on this rotation. Expected fast wind arrival, based upon calculation from the leading edge of this feature, would suggest arrival on the 9th, however 27-day persistence indicates a slight enhancement from late on the 8th. Given the more intense appears of this feature, a faster arrival seems more likely than a slower one, suggesting an arrival on the 8th is most likely. Enlil also has one broad arrival, providing additional confidence for reduced time between CH09 fast wind and CH10 fast winds, with solar winds likely reaching around 550-600 km/s.

Geomagnetic activity will initially be Quiet to Unsettled with Active spells possible, with a chance of isolated G1/Minor Storm intervals day 1 (7th) due to CH09 fast wind arrival. Activity rising further to Active to G1/Minor Storm intervals, with the arrival of the faster winds of CH10, likely day 2 (8th). Easing to Quiet to Active by day 4 (10th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	60	30	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC 27 day persistence model – Weak enhancement visible on the 8th, rising through the period towards 550km/s by 10th.

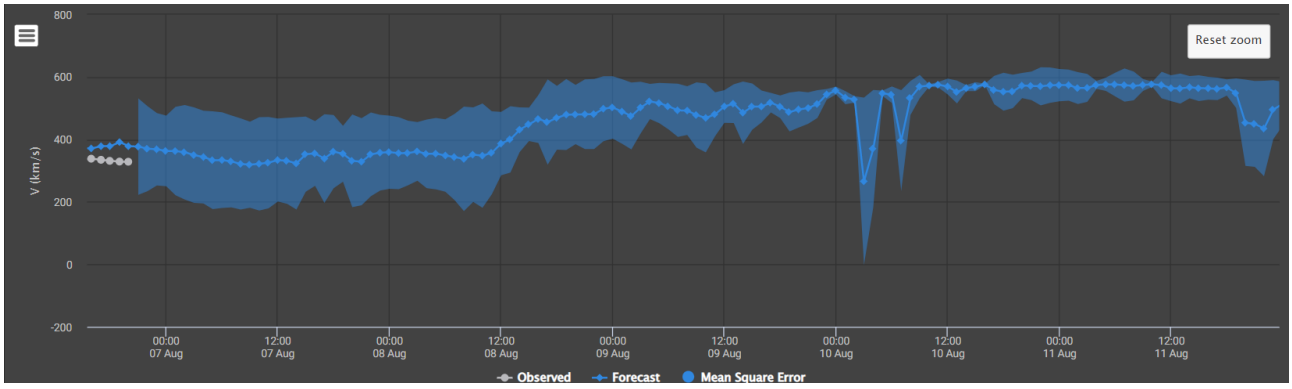

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Figure 3: SDO aia-211 images

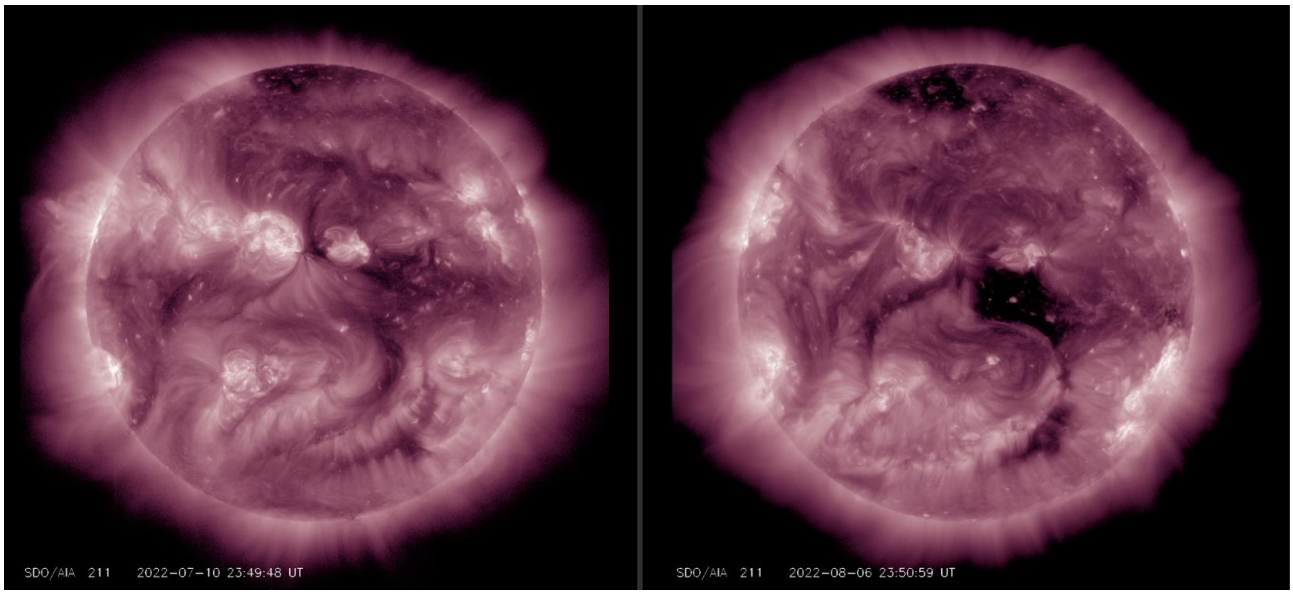
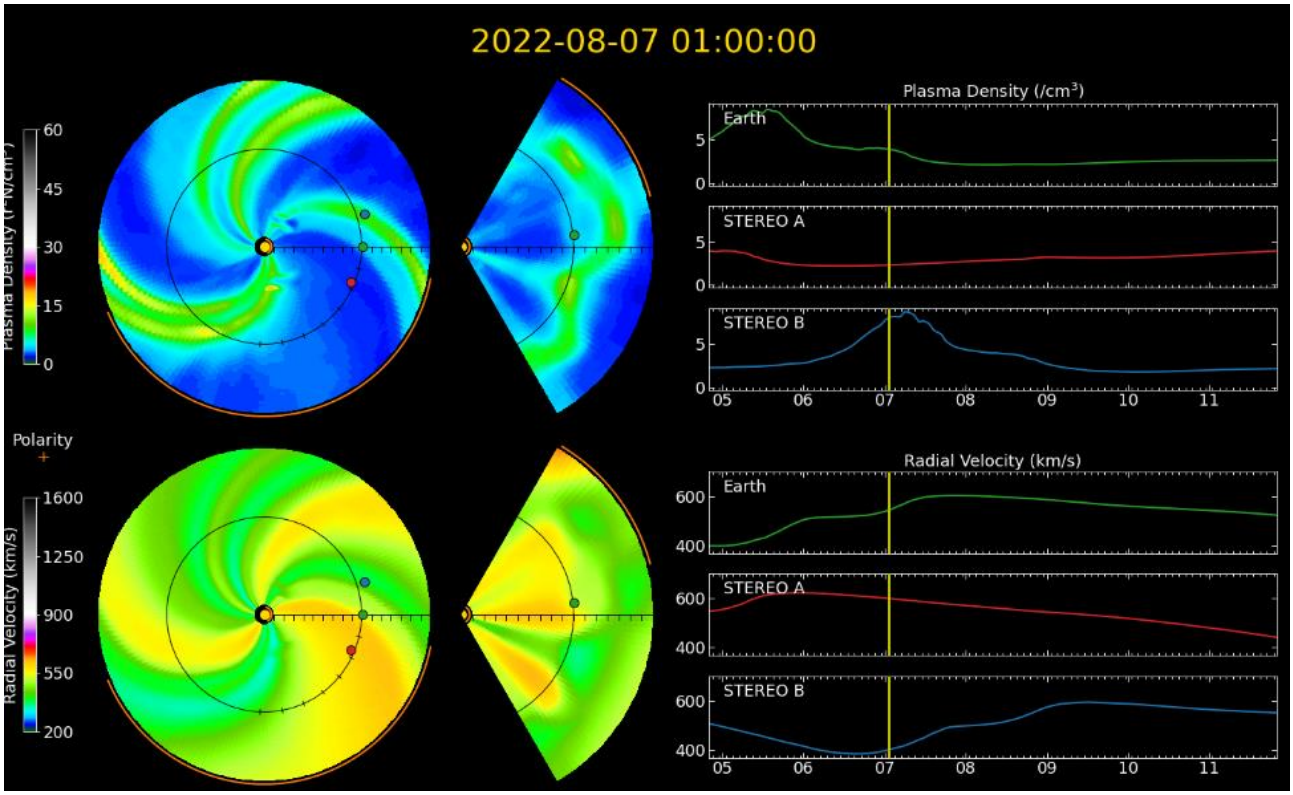


Figure 3: Enlil with one broad enhancement from the 7th



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Radio Blackouts - X-Ray Flares:

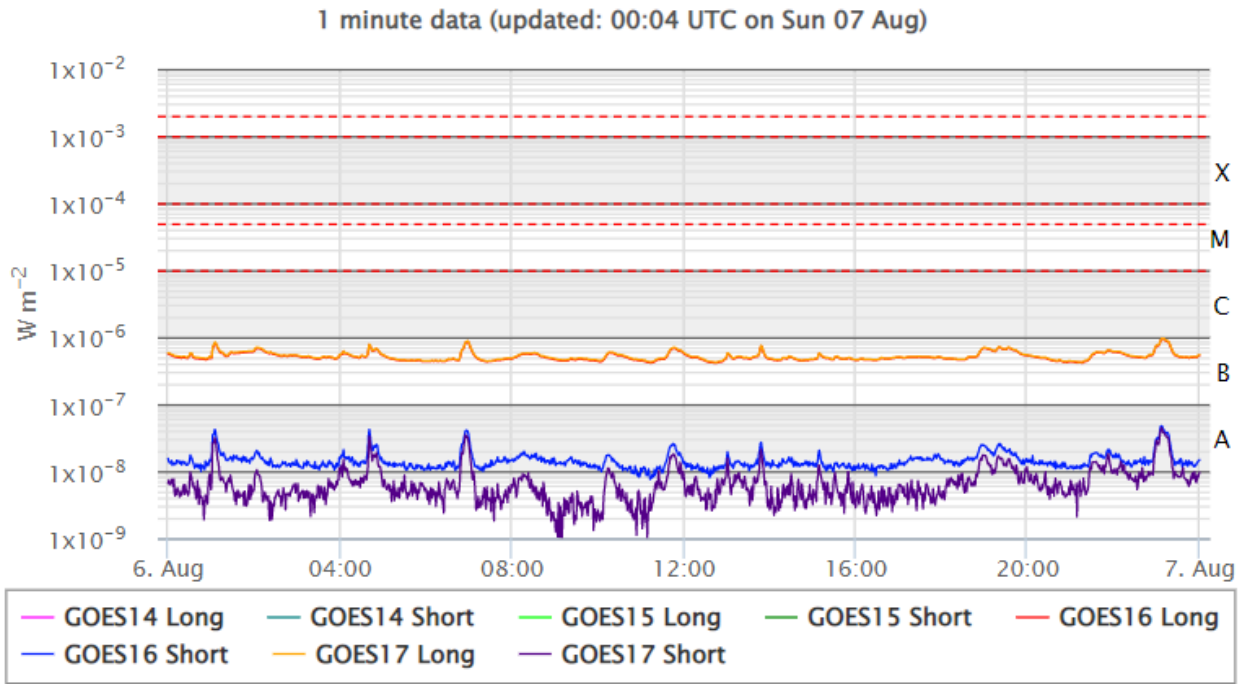
There are currently five numbered sunspot regions on the Earth-facing disc, and two further yet to be numbered sunspot regions. Despite this, activity has been Very Low in the last 24 hours, with only B-class flares observed.

The three active region in the southwest remain small and relatively simple magnetically, with only limited development, however they have been the main source of the B-flares. However these are now moving beyond 60W, and therefore becoming harder to analyse. The other two numbered regions are stable unipolar regions. The two unnumbered regions, both in the northeast, include a newly emerging spot and a larger currently unipolar region. This region could yet reveal further details as it rotates onto the disc.

Low to Very Low activity is expected, with further C-flares likely, and a slight chance of M-flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/17 X-ray Flux



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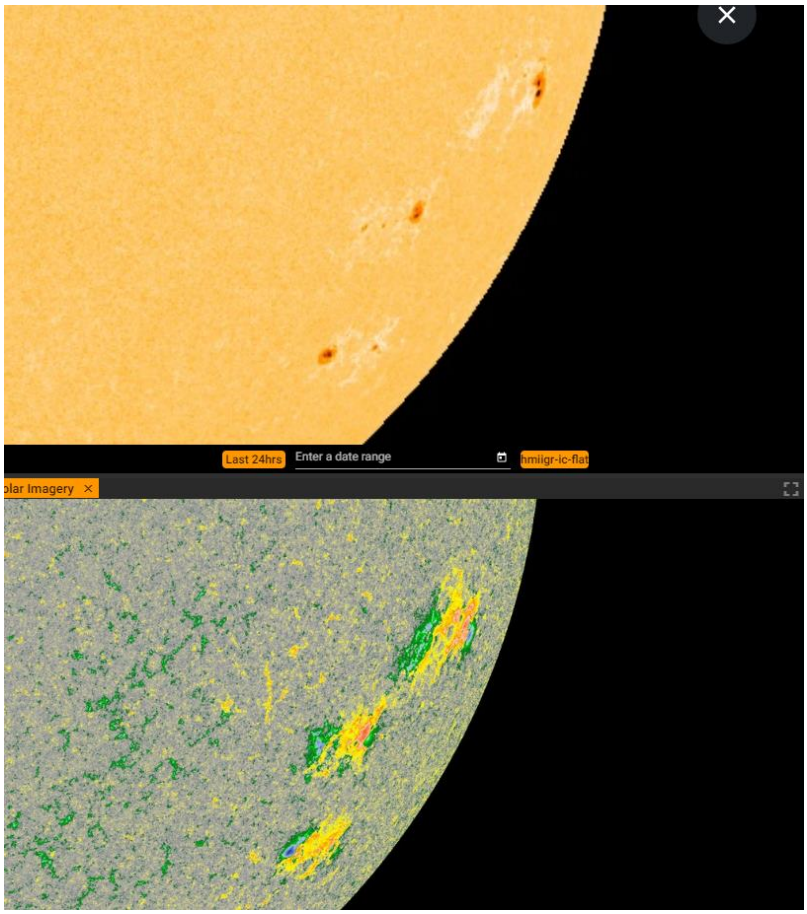
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background, and is expected remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDO hmi-intesitygram and magnetogram of the SW disc (AR3068, AR3071 and AR3072 from top to bottom)



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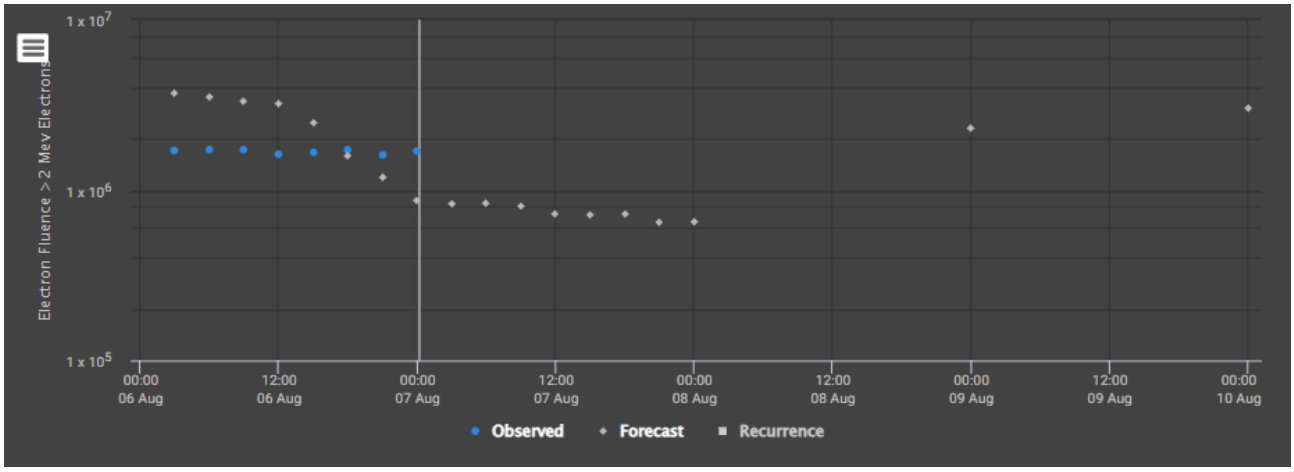
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16, is currently at background levels. Despite an imminently expected enhancement to the solar wind environment from the fast wind of CH09, electron populations amongst the Van Allen Belts are expected to only slightly rise as a result. A more notable enhancement is then expected day 2 (8th), with the fast wind of CH10/+. Flux levels then rising day 3 onward (9th), perhaps peaking at high during periods of diurnal maximum.

The associated fluence is expected to persist below the Active threshold, but with a rising trend, and a chance of rising above the Active threshold by the end of day 4 (10th). This rising trend, perhaps above the Active threshold is likely to continue beyond the period. This is supported by REFM, which maintains levels below Active, but with a rising trend by the end of the period.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	20	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: >2MeV Electron Fluence with REFM



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